Ecological Site Description ID:	F236XY111AK—Boreal Forest Loamy Flood Plains

Ecological Dynamics of the Site:

This boreal ecological site is on lowland high flood plains. It is typically at sea level to an elevation of 846 feet with slopes of 0 to 5 percent. Slope aspect does not appear to influence the plant community dynamics of this site because it is on all aspects.

This ecological site is correlated to D36-Boreal forest loamy flood plains, Kokwok, and Lowithla soils. Soil characteristics that are likely to influence plant community dynamics include the cryic soil temperature regime and the aquic moisture regime for soils mapped at the Order 3 level of intensity and udic moisture regime for soils mapped at the Order 2 level. Soil permeability is typically slow to a depth of 40 inches. The first mineral horizon is moderately acidic to extremely acidic (pH 5.9 to 4.4), and the organic material content in the surface layer is commonly 1 to 9 percent. The annual precipitation is 24 to 50 inches, and the annual frost-free period is 85 to 140 days. The parent material of the soils mapped at the Order 3 level is grassy organic material over coarse-silty alluvium over coarse-loamy alluvium. The parent material of Order 2 soils is organic material over coarse-loamy alluvium over sandy and gravelly alluvium.

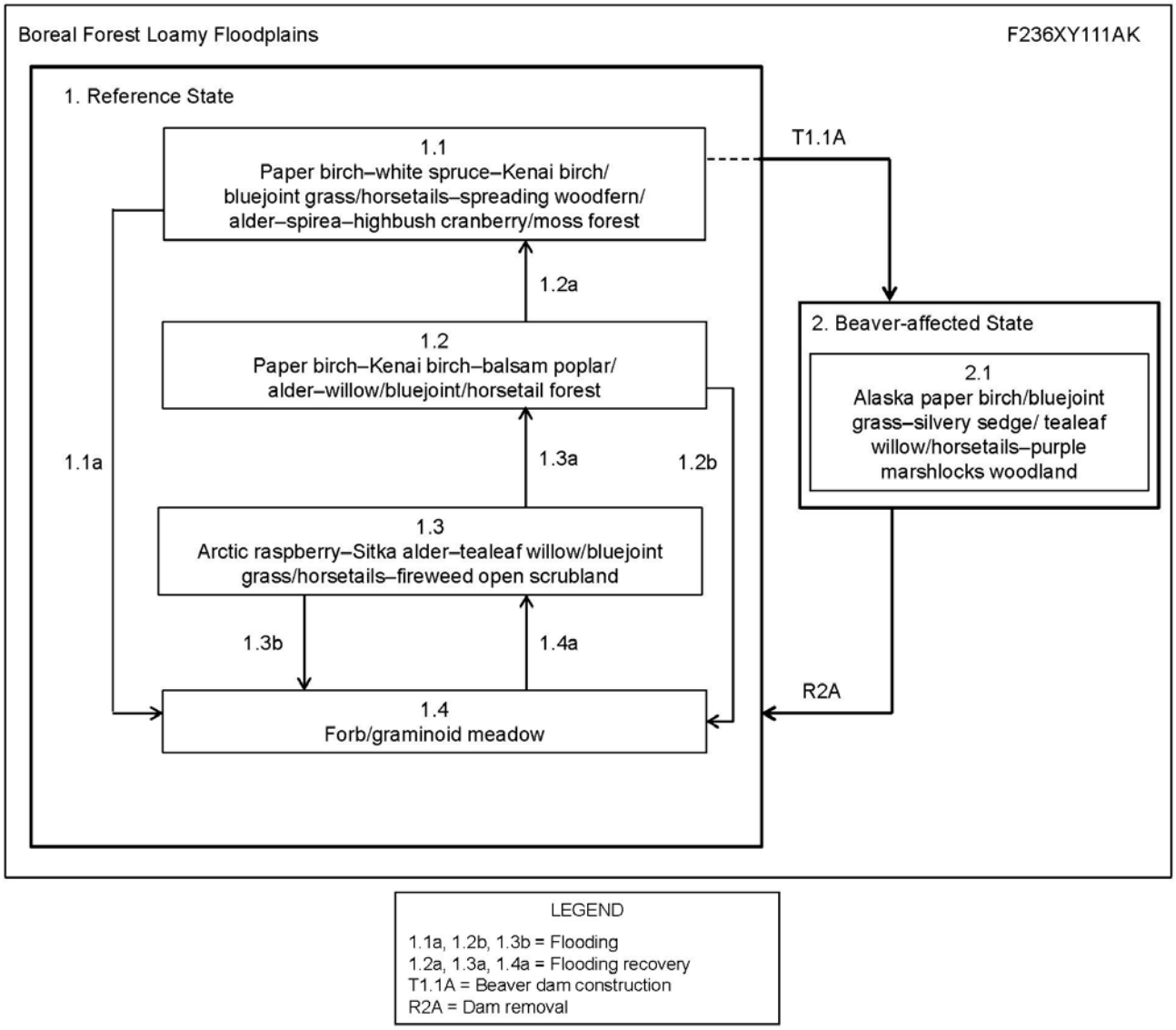
The reference community phase is typified by mixed forest with an understory of dominantly graminoids and forbs. Ecological site F236XY150AK (Boreal Forest Loamy Flood Plains, Wet) is also on boreal high flood plains. It is subject to occasional, brief periods of ponding due to its concavity, proximity to wetlands, and poorly drained soils. This site (F236XY111AK) is not concave, and the soils are moderately well drained or well drained. They are subject to rare periods of ponding. Differences in soil characteristics and disturbance regimes lead to dissimilarities in reference states and community phases; therefore, separate ecological sites are needed.

Flooding is the major disturbance regime documented for this ecological site, and it is considered a natural event that is typically unmanaged. The low elevation and slope and the natural proximity to a river system make the area susceptible to rare or occasional flooding. The available background information suggests that the intensity of flooding and time since flooding occurred greatly affect the distribution and abundance of vegetation in Alaskan riverine systems (Wohl, 2007). Flooding can generate an opportunity for plant succession by creating barren and moist areas that can be colonized, burying organic layers, adding nutrients to the soil, and depositing seed banks (Rood and others, 2007; Yarie and others, 1998). Rare post-flood ponding may also affect plant community composition and transitions. Flooding on these high flood plains is responsible for three community phases in addition to the reference community phase.

Slight to heavy browsing by moose on willows is possible on this site, but it does not appear to affect the ecological processes enough to significantly alter the plant communities.

Some beaver-affected areas have been observed on this high flood plain ecological site. In these areas, Alaska paper birch (*Betula neoalaskana*), bluejoint grass (*Calamagrostis canadensis*), and hydrophilic forbs typically surround the ponded areas that are upstream from the beaver dams. After the dams are blown out, either by man or natural causes, these areas are expected to return to the reference state; however, this has not been observed *in situ*. A hypothetical second alternative state caused by tree thinning or harvesting may also be associated with this ecological site, but this was not observed in the field.

State and Transition Diagram:



State ID Number:	1	State Name:	Reference State
State Narrative:	The reference state supports four community phases, grouped by the structure and dominance of the vegetation (e.g., coniferous trees, deciduous trees, shrubs, and forbs) and their ecological function and stability. The presence of these communities is temporally dictated by rare periods of flooding. The reference community phase is mixed forest with an open understory of bluejoint grass (*Calamagrostis canadensis*) and diverse forbs and shrubs. A transition to an alternative state is caused by the damming of a nearby drainageway or stream by beavers (*Castor canadensis*). This report provides baseline vegetation inventory data for this site. Future data collection is needed to provide further information about existing plant communities and the disturbance regimes that would result in transitions from one community to another.		

Phase 1.1			
Community Phase Number:	1.1	Community Phase Name:	Paper birch-white spruce-Kenai birch/bluejoint grass/horsetails-spreading woodfern/alder-spirea-highbush cranberry/moss forest
Community Phase Narrative:			
The reference community phase for this ecological site is characterized by mixed coniferous and deciduous forest with an open understory of bluejoint grass (*Calamagrostis canadensis*) and diverse forbs and shrubs. Annual production is visually estimated to occur somewhat equally among plant groups, but annual forbs and graminoids can have especially high productivity. The majority of the tree cover in this forest community occurs in the tall and medium strata. Typically, the dominant species are white spruce (*Picea glauca*) and paper birch (*Betula papyrifera*), but other trees such as Alaska paper birch (*Betula neoalaskana*), Kenai birch (*Betula papyrifera var. kenaica*), and balsam poplar (*Populus balsamifera*) may also be present. The dominant understory species include bluejoint grass (*Calamagrostis canadensis*), arctic raspberry (*Rubus arcticus*), spreading woodfern (*Dryopteris expansa*), and horsetails (*Equisetum spp.*). Other common but less abundant species may include highbush cranberry (*Viburnum edule*), alder (*Alnus spp.*), and spirea (*Spiraea stevenii*). Feathermosses, such as splendid feathermoss (*Hylocomium splendens*) and knights plume moss (*Ptilium crista-castrensis*) are common on the surface along with a very minor component of lichens. Other ground cover commonly includes herbaceous litter (~64 percent average cover) and woody litter (~9 percent). About 1 percent is bare soil.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
T	White spruce	*Picea glauca*	PIGL	193.2*	21.0~
T	Paper birch	*Betula papyrifera*	BEPA	61.4	34.6~
T	Kenai birch	*Betula papyrifera var. kenaica*	BEPAK	54.5	33.2~
S	Highbush cranberry	*Viburnum edule*	VIED	78.4	9.2
S	Arctic raspberry	*Rubus arcticus*	RUAR	76.1	6.9
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	96.6	42.6
F	Spread woodfern	*Dryopteris expansa*	DREX2	83.0	7.4
F	Horsetails	*Equisetum spp.*	EQUIS	40.9, 27.3, 78.4^	12.8, 22.9, 25.0
M	Feathermosses	Includes three genera		50.0, 12.5, 28.4#	21.8, 6.3, 7.9

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant group to have a constancy value of more than 100 percent.

~ Tall, medium, and stunted individuals are counted as canopy trees. Regenerative individuals are not included.

^ Horsetails (*Equisetum spp.*) are represented by three species—*E. arvense, E. pretense,* and *E. sylvaticum,* respectively.

Feathermosses are represented by three species—*Hylocomium splendens, Pleurozium schreberi,* and *Ptilium crista-castrensis*, respectively.

Community Pathways

Pathway Number	Pathway Name & Description
1.1a	Flooding. Major flooding events can inundate the high flood plains, likely causing erosion, sediment deposition, and vegetation scouring. Rare post-flood ponding may also affect plant community composition and transitions. This may result in areas where forbs and graminoids could colonize and some water-tolerant tree and shrub species could survive. The frequency of flooding is rare or occasional. White spruce (*Picea glauca*) trees are 55 to 200+ years old (mean: 105 years), suggesting that the typical major flood regime is once per century (100 years).

Phase 1.2			
Community Phase Number:	1.2	Community Phase Name:	Paper birch-Kenai birch-balsam poplar/alder-willow/bluejoint grass/horsetail forest
Community Phase Narrative:			
This is the late flooding community phase, characterized by deciduous forest with an understory that consists dominantly of bluejoint grass (*Calamagrostis canadensis*) and various shrubs and forbs. Annual production is visually estimated to occur relatively equally among shrubs and graminoids. Production is thought to be more than that of the more shaded reference community phase (1.1) due to higher shrub and graminoid production; however, it likely is dependent on the local abundance of specific species, such as bluejoint grass and trees. Deciduous trees are dominant, commonly including two or more of the following species—balsam poplar (*Populus balsamifera*), paper birch (*Betula papyrifera*), Kenai birch (*Betula papyrifera var. kenaica*), and Alaska paper birch (*Betula neoalaskana*). The understory community commonly includes bluejoint grass (*Calamagrostis canadensis*), arctic raspberry (*Rubus arcticus*), alder (*Alnus spp.*), and horsetails (*Equisetum spp.*). Other less common understory species include various shade-tolerant, competitive forbs such are arctic starflower (*Trientalis europaea*), spreading woodfern (*Dryopteris expansa*), fireweed (*Chamerion angustifolium*), and western touch-me-not (*Impatiens noli-tangere*) and colonizing highbush cranberry (*Viburnum edule*). Ground cover commonly consists of patchy mosses (~18 percent average cover) with a very minor component (~1 percent) of lichens. Other ground cover commonly includes herbaceous litter (~82 percent average cover) and woody litter (~8 percent). About 1 percent is bare soil.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
T	Paper birch	*Betula papyrifera*	BEPA	41.6	49.1*
T	Kenai birch	*Betula papyrifera var. kenaica*	BEPAK	29.2	46.3*
T	Balsam poplar	*Populus balsamifera*	POBA2	66.7	38.5*
S	Alder	*Alnus spp.*	ALNUS	37.5, 29.2^	23.0, 20.4
S	Arctic raspberry	*Rubus arcticus*	RUAR	66.7	5.5
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	61.6
F	Horsetails	*Equisetum spp.*	EQUIS	45.8, 16.7, 58.3#	15.0, 38.8, 18.0
F	Arctic starflower	*Trientalis europaea*	TREU	70.8	1.3
F	Northern bedstraw	*Galium boreale*	GABO2	62.5	3.0

* Tall, medium, and stunted individuals are counted as canopy trees. Regenerative individuals are not included.

^ Alders (*Alnus spp.*) are represented by two species—*A. incana ssp. tenuifolia* and *A. viridis ssp. sinuata*, respectively.

Horsetails (*Equisetum spp*.) are represented by three species—*E. arvense*, *E. pretense,* and *E. sylvaticum,* respectively.

Community Pathways	
Pathway Number	Pathway Name & Description
1.2a	Natural succession: Normal time and growth without disruptive flooding. It is probable that as time passes, white spruce trees will increase in size and abundance, outcompeting willow and alder for light and space, causing their populations to decline. The time needed for this transition to occur is currently unknown, but it is likely partially determined by the spread and growth rate of white spruce.
1.2b	Flooding. Though the flooding regime of this ecological site is described as rare to occasional, a flooding event within about 45 to 75 years of the last major flood will likely have similar effects as those described for transition pathway 1.1a.

Phase 1.3			
Community Phase Number:	1.3	Community Phase Name:	Arctic raspberry-Sitka alder-tealeaf willow/bluejoint grass/horsetails-fireweed open scrubland
Community Phase Narrative:			
This mid flooding community phase is typified by an open scrubland community containing a mix of shrubs with large open areas of bluejoint grass (*Calamagrostis canadensis*) and pioneer (disturbance-loving) forbs. Annual plant production is visually estimated to be concentrated amongst graminoids and forbs. The most common medium and tall shrubs include alders (*Alnus spp.*) and tealeaf willow (*Salix pulchra*). Regenerating and hardy trees that survived the previous flooding disturbance may be present and can include any or all of the species encountered in the reference community phase. Open areas are that consists dominantly of bluejoint grass and also regularly contain American red raspberry (*Rubus idaeus*), fireweed (*Chamerion angustifolium*), kneeling angelica (*Angelica genuflexa*) and horsetails (*Equisetum spp.*). Surface cover can include myriad mosses (~53 percent average cover), herbaceous litter (~65 percent), and woody litter (~4 percent). As much as 1 percent is areas of bare soil.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Alder	*Alnus spp.*	ALNUS	33.3, 33.3^	38.5, 45.0
S	Tealeaf willow	*Salix pulchra*	SAPU15	50.0	10.0
S	American red raspberry	*Rubus idaeus*	RUID	83.3	12.8
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	59.2
F	Horsetails	*Equisetum spp.*	EQUIS	33.3, 50.0, 50.0#	7.5, 28.3, 30.3
F	Spreading woodfern	*Dryopteris expansa*	DREX2	66.7	17.1
F	Tall Jacob's-ladder	*Polemonium acutiflorum*	POAC	66.7	1.4

^ Alders (*Alnus spp.*) are represented by two species—*A. incana ssp. tenuifolia* and *A. viridis ssp. sinuata.*

Horsetails (*Equisetum spp.)* are represented by three species—*E. arvense, E. pretense,* and *E. sylvaticum,* respectively.

Community Pathways

Pathway Number	Pathway Name & Description
1.3a	Natural succession: Normal time and growth without disruptive flooding. It is likely that as time passes without further flooding, competitive existing and colonizing shrubs and trees will increase in abundance and diversity. Graminoid and forb populations may also continue to diversify, as the possibility of new ecological niches expands. The time needed for this transition to occur is unknown, but it is likely at least partially dependent on the colonization and growth rate of shrubs and trees.
1.3b	Flooding. Though the frequency of flooding on this ecological site is rare or occasional, a flooding event on plant community 1.3 likely will have similar effects as those described for transition pathway 1.2a. The probability of flooding on this community soon after a previous event is relatively low.

Phase 1.4	Photograph not available (community not observed in field).		
Community Phase Number:	1.4	Community Phase Name:	Forb/Graminoid Meadow
Community Phase Narrative:			
This early flooding community phase is typically characterized by pioneer (disturbance-loving) forbs and graminoids. These commonly fast-growing plants typically spread by way of water- or wind-borne seeds, allowing for quick colonization after a disturbance. Graminoids may include bluejoint grass (*Calamagrostis canadensis*) and various sedges (*Carex spp.*). A species-rich group of forbs may be present and probably will consist of one or more of the following—fireweed (*Chamerion angustifolium*), horsetails (*Equisetum spp.*), goldenrods (*Solidago spp.*), and others. Hardy individual shrubs and trees that survived the flooding may be in the community; however, the majority of annual production is expected to be from the graminoids and forbs. Note: This early flooding community phase was not observed in the field. This description is based on published literature and similar early post-flooding community phases that have been observed on flood plains in southwestern Alaska.			
Community Pathways			
Pathway Number	Pathway Name & Description		
1.4a	Natural succession: Normal time and growth without disruptive flooding. It is likely that as time passes, shrubs will colonize and spread. Existing forb populations competing for space and sunlight may decrease, but overall forb species richness is expected to increase as niches increase. Graminoids, particularly bluejoint grass, will continue to thrive with the shrubs.		
State ID Number:	2	State Name:	Beaver-affected Areas
State Narrative:	This alternative state results from beaver ponding. Beavers (*Castor canadensis*) directly kill trees and large shrubs to use for food and dam construction and also indirectly kill these species and others by raising the water table (FS-R10-FHP, 2013). Ponding generally creates a vegetative community that is different from those normally on these flood plains. This plant community commonly includes resilient individuals extant in the reference community phase as well as pioneer hydrophilic species. The permanent ponding associated with areas upstream of beaver dams can negate the influence of flooding on the soils and vegetation. The vegetative community is likely to remain relatively stable until the dam is removed. Upon removal, either by natural dam blowing, beaver abandonment, or human intervention, it is thought that the plant community will revert to the reference state, but further research is needed to quantify the *in situ* outcome of dam removal. Of note, moderate to severe browsing of willow by moose has been observed on this alternative state community. This browsing may prevent willows from becoming dominant, thereby keeping the community open woodland rather than transitioning to closed scrubland.		

Phase 2.1			
Community Phase Number:	2.1	Community Phase Name:	Alaska paper birch/bluejoint grass-silvery sedge/tealeaf willow/horsetails-purple marshlocks woodland
Community Phase Narrative:			
This community phase is associated with areas surrounding beaver ponds. It is characterized by open woodland with disturbance-loving, hydrophilic species in the understory and in non-treed areas. This woodland generally consists dominantly of Alaska paper birch (*Betula neoalaskana*) in the medium and regenerative strata. The understory and open areas commonly support similar species, including bluejoint grass (*Calamagrostis canadensis*), purple marshlocks (*Comarum palustre*), tealeaf willow (*Salix pulchra*), and arctic raspberry (*Rubus arcticus*). Less dominant understory species generally include various willows (*Salix spp.*), horsetails (*Equisetum spp.*), spreading woodfern (*Dryopteris expansa*), and fireweed (*Chamerion angustifolium*). Ground cover typically consists of moss clusters (~23 percent average cover), herbaceous litter (~95 percent), woody litter (~2 percent), and surface rock fragments (~1 percent). About 5 percent is bare soil.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
T	Alaska paper birch	*Betula neoalaskana*	BENE4	200.0*	12.5^
S	Tealeaf willow	*Salix pulchra*	SAPU15	100.0	26.0
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	85.0
F	Purple marshlocks	*Comarum palustre*	COPA28	100.0	10.1
F	Arctic raspberry	*Rubus arcticus*	RUAR	100.0	7.6
F	Horsetails	*Equisetum spp.*	EQUIS	100.0, 50.0, 50.0#	27.5, 40.0, 6.0
F	Fireweed	*Chamerion angustifolium*	CHAN9	100.0	7.6

* Trees may be present in multiple strata within one plot; therefore, it is possible for species of this plant group to have a constancy value of more than 100 percent.

^ Tall, medium, and stunted individuals are counted as canopy trees. Regenerative individuals are not included.

Horsetails (*Equisetum spp.)* are represented by three species—*E. arvense, E. pretense,* and *E. sylvaticum,* respectively.

Note: The vegetation and soils for this plant community phase were sampled at two separate locations. Due to the limited data available for this community phase, personal field observations were used to aid in describing this plant community.

State Transitions and Restoration Pathways

State Transition Pathways			
Transition Number	From	To	Transition Narrative
T1.1A	1	2	This transition is caused by the damming of a water source by beavers. Areas surrounding beaver ponds may support plant assemblages distinct from those typically on these high flood plains. The vegetative community generally is comprised of species that are water tolerant and can reproduce in wet soils. Areas surrounding beaver ponds might be susceptible to flooding or ponding after rainfall and snowmelt. This prevents the vegetative community from supporting non-hydrophilic species, which may keep the plant community composition relatively stable. The time required for this transition to occur is dependent on the presence and activity of beavers.
State Restoration Pathways			
Restoration Pathway Number	From	To	Restoration Pathway Narrative
R2A	2	1	This restorative pathway to the reference state occurs in areas where a beaver dam bursts. This can be a result of flood damage, beaver inactivity, or anthropogenic activity. Once the dam is removed, the plant community is expected to transition back to the reference state. However, this would depend on various factors such as the existing seed bank, propagule recruitment, and return of the natural flooding regime. Further research and *in situ* documentation is required to fully describe this transition.

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This report is interim and subject to change.